

Copper Nitrate, Water and Nitrogen Dioxide or Nitric Oxide are produced, thus $3\text{Cu} + 8\text{HNO}_3 = 3\text{Cu}(\text{NO}_3)_2 + \text{N}_2\text{O}_2 + 4\text{H}_2\text{O}$.

(c). When Starch or Arsenic Trioxide is boiled with Nitric Acid, Nitrogen Trioxide (or Nitrous and Hydride) is given off, thus: $\text{As}_2\text{O}_3 + 2\text{HNO}_3 + 2\text{H}_2\text{O} = 2\text{H}_3\text{AsO}_4 + \text{N}_2\text{O}_3$.

(d). Nitrogen Tetroxide (NO_2) can be prepared by heating Nitrate of Lead, when it is broken up, into Oxide of Lead, and Oxygen Nitretetroxide $\text{Pb}(\text{NO}_3)_2 = \text{PbO} + \text{O} + \text{N}_2\text{O}_4$. This gas, mixed with N_2O_3 , is also produced when NO_2 comes in contact with air or Oxygen.

4. (a). Neither Carbon Dioxide or Nitrogen will support combustion, but if lime water be put into a flask containing the former, it will become muddy from the formation of Calcium Carbonate.

(b). This is answered above. when test for Carbon Dioxide is given.

(c). Marsh gas is heavier than Hydrogen, as it contains Carbon it burns with a more luminous flame, producing both Water and Carbon Dioxide, which, tested for as above, distinguishes it from Hydrogen, which produces only Water when burnt.

(d). Olefant gas burns with a much more luminous and smoky flame than Carbon Monoxide. It can be recognized by its peculiar odor. Both gases produce Carbon Dioxide when burnt, but only the Olefant gas produces Water, hence, it can be thus determined.

5. (a). Sulphur resembles Oxygen in forming a number of Sulphides which are analogous to Oxides, thus:

H_2O	is analogous in composition to	H_2S .
KHO	"	KHS .
K_2O	"	K_2S .
Ag_2O	"	Ag_2S .

(b). Sulphur Dioxide can be prepared by boiling Copper, Mercury, Carbon, and with Sulphuric Acid, thus: $\text{Cu} + 2\text{H}_2\text{SO}_4 = \text{CuSO}_4 + 2\text{H}_2\text{O} + \text{SO}_2$.

(c). Sulphur unites with Potash to form Potassic Sulphite, thus: $\text{KHO} + \text{SO}_2 = \text{KHSO}_3$ or $2\text{KHO} + \text{SO}_2 = \text{K}_2\text{SO}_3 + \text{H}_2\text{O}$.

(d). Sulphur Dioxide slowly removes the Oxygen from the water in which it is dissolved, while Chlorine tends to remove the Hydrogen from the water in which it is dissolved, therefore the mixed solutions break up a portion of the water, the Oxygen uniting with the Sulphur Dioxide to form Sulphuric Acid, and the Hydrogen uniting with the Chlorine to form Hydrochloric Acid. Therefore, Sulphuric and Hydrochloric Acids result from the mixture of the solutions.

6. In each lb. of bone ash $\frac{62}{403 + (31 + 16 \cdot 4)_2} = \frac{1}{2}$ consists of Phosphorus; therefore $\frac{1}{2}$ of $120 \times \frac{62}{100}$ or 212.16 lbs. consists of Phosphorus.

In 480 grains of Microcosmic Salt $\frac{13}{23 + 14 + 4 + 1 + 31 + 64 + 4(18)} = \frac{1}{208}$ of the whole is Hydrogen, $\frac{1}{208} \times 480 = 29.8$ is quantity of H. $29.8 \div 37 = .805$ cubic feet.

7. Percentages of chemical constituents in a compound substance are the numbers expressing the relative weight of the components to each other. The molecular formulae express the ratio of the components to each other in number of atoms. From the percentage composition, the former can be found by expressing the ratios of the components in the percentage weights divided by their atomic weights, thus: $\text{C} : \text{H} : \text{O} :: \frac{54.5}{12} : \frac{9.2}{1} : \frac{36.3}{16}$. Clearing of fractions the formulae becomes $\text{C}_2\text{H}_4\text{O}$.

8. (a). In the flame of an ordinary coal oil lamp, without a chimney, much of the Carbon of the oil is unconsumed from want of Oxygen. The illumination is not brilliant, first, on account of the smoke, and again because the temperature of the flame is not at its greatest, since part of the burning material is unconsumed for want of air. If the chimney be placed on the lamp, a current of air rushes through, burning up the Carbon, thereby clearing the light of soot and raising temper-